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Assessing Information Flow and Decision Making in a Field Artillery Command and Control Exercise

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13. ABSTRACT (Maximum 200 words)

The U.S. Field Artillery School (USAFAS) at Fort Sill, Oklahoma, uses a computer-supported Command post exercise (CPX) to train soldiers attending classes in Field Artillery Fire-Support Command, Control, and Communications. The students, divided into groups, act as the fire support, operations, intelligence, and fire direction elements of a Field Artillery Battalion supporting a Mechanized Infantry Brigade conducting offensive operations in a European environment. The students receive a total of 450 computer-generated messages in TACFIRE formats and, at each position, must make decisions and respond to the battlefield situation. The CPX scenario was analyzed to identify performance measures that could be obtained by modifying the CPX software or by videotaping one or more of the sections. This report provides (a) a detailed description of the CPX (scenario, hardware and software, and facilities) used at the USAFAS, (b) a list of the proposed performance measures, and (c) a description of the modifications made to the CPX software to allow for performance data collection and reporting.

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FOREWORD

As the Army prepares to conduct warfare in the context of Airland Battle doctrine, tactical decision-making ability is being emphasized at lower echelons of the command and control structure. To facilitate this, the Army is using sophisticated, computer-supported information processing systems for staff aiding and staff training exercises. The following report describes (a) the computer-supported command post exercise (CPX) used at the U.S. Army Field Artillery School (USAFAS) to train officers in command staff procedures, (b) the development of performance measures to be collected during CPX execution, and (c) the modifications made to the CPX computer program to collect and report the performance data.

This effort is part of a broader program being conducted by the U.S. Army Research Institute for the Behavioral and Social Sciences (ARI) on evaluating the ability of humans to operate and communicate effectively in teams and in computer-aided environments. The ARI Field Unit at Fort Sill, Oklahoma, has been conducting a number of studies designed to aid the USAFAS in developing objective measures to assess team performance. Results of this effort and the products developed were provided to the USAFAS in February 1991.

ASSESSING INFORMATION FLOW AND DECISION MAKING IN A FIELD ARTILLERY COMMAND AND CONTROL EXERCISE

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Introduction

Background

There is concern throughout society regarding the ability of humans to receive, process, and disseminate information during periods of high workload, time pressure, and stress. Within the military, the command and control of forces function is almost entirely composed of tasks that involve the reception, processing, and dissemination of information. It is also the case that workload, time pressure, and stress, both task-induced and enemy-induced, are highest during the most critical parts of the engagement process. In order to make the command and control process dependable and timely, the Army is continuing its efforts to make increased use of computer technology, both for staff aiding systems in command posts and for contributions to the staff training process.

At the United States Army Field Artillery School (USAFAS), officers are schooled in staff procedures in the classroom and in command post exercises (CPXs). The CPXs are computer-supported battle simulations that give officers-in-training an opportunity to perform the staff functions they have learned in the classroom in a situation where workload and time pressure constraints can be controlled and where, at least, the task-induced stresses of battle situations can be meaningfully simulated.

A problem associated with the current CPX process is that there is no timely method to obtain and evaluate data concerning individual or group performance on the staff processing tasks being performed. Because objective performance data is not available, the instructors who control the CPXs must lean heavily on personal observation and their own experiences to evaluate student performance. Clearly a real-time, or near real-time, automated data collection system that can capture relevant performance data, evaluate these data, and provide the instructor with objective measures of student and group performance is needed.

Accordingly, this project was designed to (a) define a set of performance measures that could be collected while the CPX was being conducted, (b) adapt or modify the CPX computer control program to provide the necessary data, and (c) develop a program that would quickly and concisely provide performance data to the instructors. The data could then be used as objective performance feedback for the students immediately after the CPX.

CPX Overview

General

The CPX is a computerized exercise that allows the officers or student players to apply the principles of fire planning and staff action while interacting with other fire support elements. The student players are divided into groups of approximately four to play the fire planning and battalion fire direction sections of a direct support field artillery battalion. The student players perform the duties of four maneuver battalion task force fire support elements (FSEs), one brigade FSE, the battalion operations and intelligence section (S2/S3), the battalion fire direction center (FDC), and a "shooter" module. The "shooter" acts as the firing batteries of the direct support battalion and the reinforcing artillery. Other elements that the artillery would communicate with (e.g., Division Artillery, maneuver units, and radar units) are played by the computer.

The computer generates messages for the student players to process. The messages are produced in a tactical fire direction computer system (TACFIRE) format. The operator or student player is required to enter data in the correct fields and then forward the message to the appropriate agency or section. The system is set up on a PC network with a central file server (INTEL 310) that runs the scenario and provides message transfer capability between each section.

Exercise Scenario

The students play the fire support, operations, intelligence, and fire direction elements of the 3rd Battalion, 42nd Field Artillery Regiment, which is in direct support of the 3rd Brigade of the 54th Mechanized Infantry Division. The 54th Division is conducting offensive operations in an European environment. Intelligence indicates the Brigade is opposed by the elements of the second echelons of two aggressor divisions. The initial threat to the 3rd Brigade is composed of battalion-sized armor counterattacks from these two aggressor divisions.

The mission of the 3rd Brigade is to conduct a forward passage of lines, to attack to seize a designated objective, and to fix and destroy the 55th Tank Regiment. To accomplish this, the Brigade is organized into four battalion task forces (TFs). The concept of the operation is to attack intermediate objectives on the Olm River with two TFs abreast, to continue the attack with one TF, and to defend against counterattack with the remaining TF. After securing the intermediate objectives, the two trailing TFs would advance toward the Brigade objective on a second axis of advance. Priority of artillery fire is initially to the lead TF and then, on order, to the TFs conducting the main attack. The artillery is directed to plan a 15 minute conventional preparation in support of the attack.

Fire Support

The purpose of fire support planning and coordination is to meet the maneuver commander's guidance and to coordinate fire support assets to support the commander's operations. To accomplish this, the supporting artillery commander provides Fire Support Officers (FSOs) with supporting personnel at each maneuver level down to company. The supporting personnel plan and coordinate the fire support (e.g., field artillery, mortars, naval gun fire, and close air support). As described previously, the CPX requires student players to perform the duties of four maneuver task force fire support elements (FSEs) and the brigade FSE. During this exercise, the FSEs (a) monitor and forward fire missions from the forward observers (FOs), (b) plot targets and prepare target lists, (c) prepare fire plans, (d) forward shell reports from the FOs and maneuver elements to the Battalion S2, (e) forward situation and intelligence reports to the appropriate agency, and (f) plot and forward the locations of the FOs.

Student Play

The student players receive computer-generated messages, directed to the appropriate section for action. Interaction between sections is limited to "manned" sections. There is no response by the computer to student-generated messages sent to unmanned sections. The computer messages are designed so that a message to a manned section starts a chain of events requiring action by the student players. Examples are as follows:

1. A fire mission from a FO (computer-generated) is initially sent to a TF FSE and is then routed to the FDC and eventually to a Firing Battery (Shooter).

2. A radar report (computer-generated) is initially sent to the Battalion S2 and is then routed to the FDC and eventually to a Firing Battery (Shooter).

3. Shell reports (computer-generated) are initially sent to the Brigade FSE and then routed to the S2. The S2 determines if the target criteria are present and then routes the reports to the FDC, who sends them on to a Firing Battery (Shooter).

4. A fire plan request (computer-generated) is initially sent to a TF FSE. The TF FSE develops a fire plan and then passes it on to the FDC.

Decisions have to be made by the student players at each level. Two decisions that always occur are (a) does the message require additional data and (b) disposition of the message. For example, some messages would be forwarded to the FDC, and the FDC would then add information or data such as which battery should fire and, if missing, the shell and fuze type. Other actions may

be based on instructions from the brigade FSE to the TF FSE. For example, the brigade FSE may want a message of interest (MOI) each time a message is sent from a TF FSE to another section.

Within the sections, the students act as the key personnel involved in fire planning or fire direction. Specifically, they are involved in making critical decisions and developing the fire planning required to support the maneuver scenario. These events are initiated by the computer-generated messages, but student groups develop the response or plan by working together. Student groups then interact with other sections through TACFIRE formatted messages or plain text messages (PTMs), if an appropriate TACFIRE message format is not available.

Description of the CPX Facility

The CPX is divided into the following four modules played by the students: (a) four Maneuver Battalion Task Force Fire Support Elements, (b) the Direct Support Artillery Battalion Operations and Intelligence Section and the Fire Direction Center, (c) a "Shooter" module which plays the Direct Support (DS) Battalion Firing Batteries and the Reinforcing Battalion Firing Batteries, and (d) the Maneuver Brigade FSE.

In the CPX scenario, the maneuver forces are controlled by the computer and all maneuver forces and artillery units are moved by the computer. Each module has a single terminal except the DS Battalion which has two. The CPX scenario is conducted in two facilities. The layout of the main CPX facility is shown in Figure 1. The codes in each section are the TACFIRE addresses which are used throughout the exercise (see Table 1). Radio nets, played over wire, are available for use in the CPX facility. However, radios are rarely used unless problems with the digital communication system are encountered. The secondary CPX facility is located in the OAC classrooms.

Although the CPX uses TACFIRE formats for message play, the program does not provide the automatic fire direction and fire planning capabilities of TACFIRE. The program does not require a TACFIRE trained operator to run the computer, but computer knowledge is helpful. The CPX scenario relationships, including the TACFIRE communication channels, are shown in Figure 2.

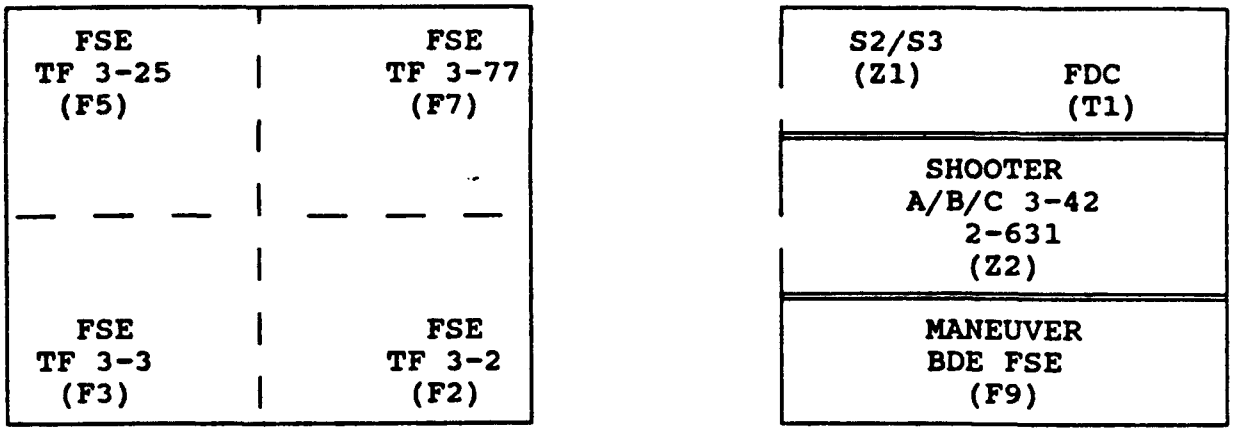

Figure 1. CPX Facility Layout

Table 1

TACFIRE Address for Student Player Sections

STUDENT PLAYERS ADDRESS	SECTION
F2	TF 3-2 FSE
F3	TF 3-3 FSE
F5	TF 3-25 FSE
F7	TF 3-77 FSE
T1	DS Bn FDC
Z1	DS Bn S2
Z2	DS/R Bn Shooter
F9	Maneuver Bde FSE

NON-PLAYERS (SCENARIO) ADDRESS	SECTION
D7	CDR 3-77
A7	A/3-77
B7	B/3-77
C7	C/3-77
T2	A/3-42 FA
T3	B/3-42 FA
T4	C/3-42 FA

NON-PLAYERS (SCENARIO) ADDRESS	SECTION
G1	DIVARTY
G2	DIV FSE
U1	2-631 FA
V1	680 TAB
H1	155 AHB
V2	3A23 RADAR
C0	CDR 3-2
A2	A/3-2
B2	B/3-2
C2	C/3-2
D3	CDR 3-3
A3	A/3-3
B3	B/3-3
C3	C/3-3
M3	MTR 3-3
C1	CDR 3-25
A5	A/3-25
B5	B/3-25
C5	C/3-25

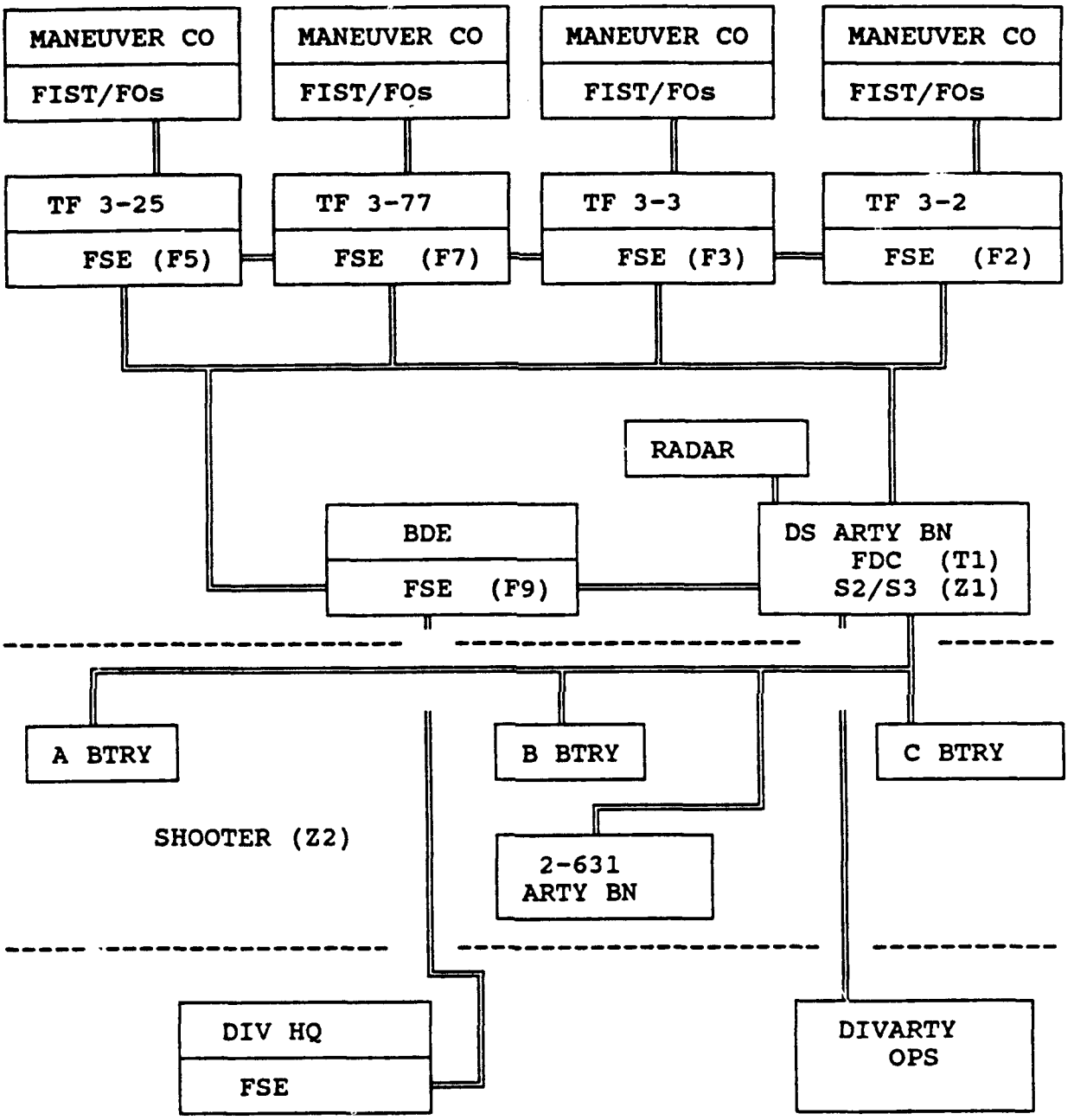

Figure 2. Scenario Organization and TACFIRE Communication Channels

Identification of Candidate Performance Measures

CPX Scenario Familiarization

Methods

Information regarding the structure of the CPX was acquired by (a) observation, (b) video-taping, (c) interviews with Subject Matter Experts (SMEs), (d) review of the CPX message printouts, and (e) analysis of the CPX software program.

Observation. Eleven CPXs were observed: (a) two reserve officer classes; (b) eight officer sections from the OAC; and (c) one advanced Non-Commissioned Officer (NCO) class. All CPXs used the same scenario and the same command post structure. Also, several manual CPXs (small group practical exercises) were observed. This provided an opportunity to observe manual procedures of fire support planning that were difficult to detect when processed by the computer.

Video taping. Portions of three exercises, conducted in the CPX facility, were video taped. Several events were clarified by viewing the video tapes, such as the actions of the S2 when processing shell reports, the handling of specific messages requiring action, and the interaction between the FDC and the S2 when determining targets derived from artillery intelligence sources.

Subject matter experts. A USAFAS SME, small group leader in charge of the CPX program, provided an overall description and explanation of the scenario from both a technical and a tactical point of view. The SME also provided the correct response for each of the scenario messages and subsequent actions that were expected to occur.

Message traffic. A printout of all scenario messages was analyzed to further understand what actions were required of the message recipients.

CPX software analysis. The CPX program, for each section, was analyzed to determine what information was available to the operators and to track the computer-generated messages.

Results

The CPX scenario generates 450 messages in TACFIRE formats. The messages are not interactive; they are output according to a predefined time schedule. The number of TACFIRE formats available to the student players is restricted in that they may be used only in response to scenario traffic. The TACFIRE formats available to the student players are shown in Table 2. A more detailed description of the messages is given in Appendix A.

Table 2

TACFIRE Formats Available to the Student Players

Message Name	Purpose
SYS; SBT	Subscriber table addresses
SPRT; TARGET LIST	Target information
SPRT; FIRE SCHEDULE	Targets by fire unit and time
SPRT; GEOM	Fire support boundaries
SYS; PTM	Plain text messages
FM; RFAF	Request for a fire mission
FM; OBCO	Friendly observer locations
FM; EOM	End fire mission, Target surveillance, and Ammunition expended
ATI; SHR	Shell report information
ATI; CDR	Artillery intelligence information
AFU; UPDATE	Updated fire unit information
AFU; BAMOUP	Fire unit ammunition status

The TACFIRE formats allow the player to fill in the required information or, in many cases, simply mark the applicable field. Compared to TACFIRE, the format used in the CPX is very user friendly. The program is selected from a menu, data entry is restricted to only the necessary fields, and, in most instances, a choice of the applicable selections is presented. An example of a request for fire (FM:RFAF) and a plain text message (PTM) are given in Figure 3.

```
FM:RFAF: TGT:CC5001;CORD:  025/  163/     ;GZ:      ;SPHERE: ;
OB:    ;FST:A7;TYPE:OP      /       ;SIZE:     /     ;ATT:     ;STR:   ;
ME;FFE /    ;CONT:    /    ;TOT:    ;
SH:    /    ;FUZE:    /    ;CHG: ;NORADS:  ;FU:       ;RAT: ;EOM: ;

SYS;PTM: REQUEST SUPPRESSIVE FIRES SIMULTANEOUSLY ON TGTS CC5001,
CC5002, AND CC5101.  BEGIN FIRING AT 0638.  CALL GROUP CIC.
```

Figure 3. TACFIRE Format Examples

Coding scenario messages. The 450 scenario messages were coded according to message type and an expected primary and alternate action is provided for each type (see Table 3). An example is the receipt of a fire mission message (FM;RFAF) by the Task Force FSE. If the FM;RFAF contained target coordinates, the message would be coded E1 and, as shown in Table 3, would require the FSE to forward the message to the FDC. However, if the FM;RFAF did not contain targets it would receive a code of E2 and the FSE or FDC would be required to obtain the coordinates from the target list, enter them in the TACFIRE FM;RFAF format, and then send the message to the FDC or the firing unit.

Critical events list. Critical CPX events, determined by reviewing the scenario and from discussions with the SMEs, are reported in Appendix B. Because many of the individual fire missions had little effect on the outcome of the exercise, most of the critical events were fire plans, requests to cancel targets, or other events such as loss of an FSO, airstrike requests, and final protective fires.

Student player decisions. The significant decisions required by the student players were determined from the development of the code list, observation of the CPXs, and interviews with the SME. Performance criteria were then developed for each of these "required" decisions. The list does not include every decision required in the exercise or in an artillery CPX, but does represent both reoccurring and major requirements of this particular exercise (see Appendix C).

Table 3

Code List for Scenario Message Actions

Code	Message Type	Primary and Alternate (A) Actions
A	SBT	Update message #1, delete from message cue
B1	TGT LIST	FDC - Update, Target store.
B2	TGT LIST	FSE - Update, Forward to FDC, BDE FSE; FDC to B1 (A) Forward to FDC only (A) Forward to BDE FSE, BDE FSE to FDC
C	PTM	TF FSE - Forward to BDE FSE, S2 (A) Forward to one only (A) Hold as information only
C1	PTM	TF FSE - Forward to BDE FSE only
D	PTM	BDE FSE - Forward to TF FSE, BDE FSE, and S2 (A) Forward only to node concerned (A) Hold for information only
E1	FM:RFAF	With coordinates - Update, Forward to FDC, FDC Forward to Fire Unit
E2	FM:RFAF	W/O coordinates - Forward to FDC, FDC enter coordinates, Forward to Fire Unit
E3	PTM:FFE	FDC - Generate RFAF to Fire Unit
E4	PTM	Generate RFAF to FDC; FDC action E1
E5	PTM	FSE - specify targets to cancel, Forward to FDC; FDC Forward to Fire Unit
H1	PTM	Series - FSE - Plot targets, create fire plan, determine Time On Target (TOT), Forward to FDC, Forward to BDE FSE (information); FDC assign Fire Unit
H2	PTM	Group - action same as H1
H3	PTM	Fire Plan - action same as H1
H4	PTM	Query FDC
H5	PTM	Forward to FDC, FDC store target
I	PTM	Message from Radar to S2; S2 will analyze and generate FM:RFAF to FDC, FDC to Fire Unit
I2	PTM	ATI:CDR from Radar source sent to FSE, Forward to S2, action same as I
J1	PTM	Information for TF FSE (A) Forward depending on traffic and Bde FSE instructions.
J2	PTM	Information for Bde FSE (A) Action if low intensity
J3	PTM	Information for DS Bn S2, no action required
K1	ATI:SHR	Forward to S2; S2 analyze, keep for action (A) Generate FM when data is sufficient
K2	ATI:CDR	Forward to S2, FM:RFAF to FDC, FDC to Fire Unit (A) S2 analyze, keep for action
K3	ATI:CDR	Forward to S2; BDE FSE (information), S2 action K2
M	FM:OBCO	TF FSE - plot locations on map, Forward to BDE FSE
N	FM:OBCO	Query FSO for location

Candidate Performance Measures

CPX Measures

CPX instructors described the types of information they would like to see available to allow them a greater capability to critique and provide feedback to the student players. This information is presented in Table 4.

Table 4

Initial CPX Measurement List

1.	Amount and type of ammunition shot by each battery.
2.	Effect of fires (Were enough rounds requested to destroy the target?)
3.	Number of missions passed from the DS Battalion to the Reinforcing Battalion.
4.	History of movement of firing units during the CPX.
5.	Record of fires on one's own elements or out of zone fires.
6.	Preparation of firing data.
7.	Actions taken by the FSE on enemy counterattacks.
8.	Number of rounds fired versus missions requested by each FSE.
9.	Mission times by each module in the firing sequence.
10.	Time to process fire plans, series, or groups.
11.	Actions taken by the FDC if unable to meet firing time.
12.	Battery movement times.
13.	Number of targets purged in the FDC and FSEs.
14.	Number of missions (if any) sent to a moving battery when other batteries could have fired.

Development of the CPX Measurement List. The Initial CPX Measurement List was used to develop the final performance measurement list. Only items that could be obtained from modifications to the CPX software program or from visual observation were included in the final list. For each item it was determined what elements or data points were required to obtain the necessary information and where, in the software program or during scenario play, the data points could be captured. This was accomplished using the previously developed message code list and by tracing the action through the message printouts. Two examples of items from the final measurement list are shown in Figure 4. The complete list is shown in Appendix D.

FM:RFAF or PTM-generated FM

1. Time received by the FSE (F*). Time is not recorded if initial message is sent directly to the Fire Direction Center (FDC).
2. Time received by the FDC (T1).
3. Time sent to the Shooter (Z2).
4. Time fired by the Shooter.
5. Did the fire request meet mission criteria for 20% offensive targets?
6. Did the FSE or FDC enter coordinates if they were not given in the RFAF? (Shooter can not complete the fire mission without coordinates.)

FIRE PLAN (SERIES OR GROUP)

1. Time received by the FSE.
2. Time sent to the FDC.
3. Time fired by the shooter?
4. Was it fired on time?
5. Did the fire request meet mission criteria for 20% offensive targets?
6. Did the FSE query the FDC as to the status of the fire plan prior to firing?
7. If unable to fire on time did the FSE take any action?

Figure 4. Examples of Measurement Items

Final List of Actions

The list of actions was examined and revised according to whether the data could be collected and whether the collection points were valid. The revised list was reviewed by the SMEs at the USAFAS and final corrections were made. The following efforts were undertaken to complete or supplement the final list:

1. Program output from the CPX player sections was analyzed to identify additional performance measures.

2. The video tapes of the latest CPXs were analyzed.

3. The CPX Decisions and Actions lists were incorporated into the measurements.

4. Targets in the scenario generated from FM:RFAF messages and target identifying radar reports were listed (see Appendixes E and F).

5. The measures of performance and measurement criteria for the software programmer and the data base were updated and placed into a workable format (see the software list and the video list in Tables 5 and 6).

6. The scenario messages providing shell report information (ATI:SHR) were plotted on the exercise map overlays and target generation data were developed (see Appendix G).

7. Boundary and geographical information, to provide fire zone data, was developed by plotting the scenario positions and determining time intervals for friendly fire information.

8. Critical events which did not fall into fire plans and target information were analyzed and initial tracking data were developed.

9. Fire Plans were analyzed to judge the order and time in which targets were introduced into the scenario (see Appendix H)

The USAFAS CPX Candidate Performance Measures List is presented in Tables 5 and 6. The performance measures were divided into two sections: (a) performance data that could be captured through modifications to the CPX software program and (b) data that could be obtained through video data collection. The measures to be collected from the CPX software program are shown in Table 5, and the measures to be collected from video data collection methods are shown in Table 6. These tables also show the start and stop points, the data points required to compute the desired information, and the methodology for manipulating the data base to produce different reports for the instructor.

Table 5

CPX Performance Measures Collected from the Software Program

1. Fire missions generated by FM:RFAF (see Appendix E)

Targets are identified by Target Number (DY4004).

Data Points:

A. Mission start time: mission generated by the scenario (standard time) and received by an FSE (F*).

B. Time received by the FDC (T1).

C. Time received by SHOOTER (Z2).

D. Time fired (Time FM:EOM message sent by Z2).

E. Total missions fired.

Measurement Information:

a. Total mission time: A - D.

b. Mission processing time: A - C.

c. FSE processing time: A - B.

d. FDC processing time: B - C.

e. SHOOTER processing time: C - D.

f. Average mission time of all missions: Total of A - D / E.

g. Average mission processing time: Total of A - C / E.

h. Average FSE processing time: Total of A - B / E.

i. Average FDC processing time: Total of B - C / E.

j. Average SHOOTER processing time: Total of C - D / E.

2. Fire Plan (Series or Group) (see Appendixes B and H)

Fire plans (FPs) are identified by name (Dave) or number (C1C).

Data Points:

A. Mission start time: FP mission generated by the scenario and received by an FSE (F*).

B. Time each target is received by the FDC (T1).

C. Time each target is received by the SHOOTER (Z2).

D. Time each target is fired (Time FM:EOM message sent by the SHOOTER).

Measurement Information:

a. Total mission time: A - D (last target in FP).

b. Mission processing time: A - C (last target in FP).

c. FSE planning time: A - B (FP or first target).

d. FDC processing time: B (first target) - C (last target).

e. Time each target in the FP is fired: FM:EOM time.

f. Total FDC processing time: Total of B - C for all FPs.

3. Target cancellation information from Critical Events List:

Data Points:

A. Message start time: mission generated by the scenario and received by an FSE (F*).

B. Time FDC (T1) notified (message time from PTM). Codeword: CHECKFIRE

C. Time received by SHOOTER (Z2).

D. Known targets from Scenario.

Measurement items:

a. Cancellation time for each mission: A - C.

b. FSE processing time for each mission: A - B.

c. Were all requested targets canceled? Compare requests received at Z2 with D.

4. Ammunition Information:

Data Points:

A. Firing Unit: From FU field in FM:RFAF message at Z2.

B. Number of rounds fired: From NORDS field in FM:RFAF at Z2.

C. Type of Round fired: From SH field in FM:RFAF at Z2.

D. Type of Fuze fired: From FUZE field in FM:RFAF at Z2.

E. Number of missions requested: FM:RFAF messages received at T1.

F. Number of missions fired: FM:EOM message sent by Z2.

Measurement Information:

a. Total Missions fired.

b. Total missions fired per firing unit.

c. Rounds fired: total, by type, and by firing unit.

d. Types of fuzes fired: total, by type, and by firing unit.

e. Total missions requested versus total missions fired.

f. Total missions requested versus total missions fired per FSE.

5. Action taken by FSE to meet firing times on Fire Plans.

Fire Plans, Series, or Groups identified by specific names.

Data Points:

A. Time-On-Target (TOT) time (FM:EOM time - first target).

B. Known TOT time (From scenario message).

Measurement Information:

Fire Plan fired on time. How late (comparison of FM:EOM time to known TOT time).

6. Fire Unit (FU) Movement Time:

Data Points:

A. Time out of Action (Start move): AFU:UPDATE message OUTTIL field (message time entered).

B. Time in: From AFU:UPDATE message OUTTIL field.

Measurement Information:

a. Time in or out of action per FU.

b. Total time out of action per FU.

c. Were any FUs moving at the same time?

d. Were any FM:RFAF messages sent to an FU when out-of-action?

7. Effects of Fire:

Data Points:

A. Rounds requested in FM:RFAF.

B. Rounds required in Weapons Effects Criteria (20% offensive targets; see Appendix I; Manual comparison).

Measurement Information:

Were enough rounds fired to destroy the target? Use target size in RFAF or default of 150x150 meters.

8. Number of Radar Targets Fired:

Data Points:

A. FM:RFAF generated for Radar Target (see Appendix F) at T1.

B. Radar target forwarded to other agency (F9 or G1) by ATI:CDR message.

Measurement Information:

a. Number and list of targets fired from Radar target list (see Appendix F).

b. Number and list of targets from Radar forwarded to other agencies.

9. Number of Shell Reports Fired:

Data Points:

A. FM:RFAF generated for Shell report (see Appendix G).

B. ATI:SHR forwarded to other agencies by Z1.

Measurement Information:

a. Number and list of missions fired in response to shell reports.

b. Number and list of shell reports forwarded.

Table 6

CPX Performance Measures Collected from Video Data

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1. Fire Unit (FU) Movement by S3: (See item #6 Software list)

Data Points:

A. Decision Start Time.

B. Decision End Time.

C. Decision Prompted by: (a) Range of FU from Forward Line of Troops (FLOT), (b) Location of FU to support future action, (c) Sufficient FUs in action to support maneuver force, (d) Threat to FU, (e) FSE, (f) Commander, (g) Instructor, and (h) Other.

Measurement Information:

A. Decision time: A - B.

B. Decision Reason: C

2. Fire Units to Fire by Fire Direction Officer (FDO):

Data Points:

A. Decision Start Time.

B. Decision End Time.

C. Decision reason: (a) FU within range, (b) Distribution of missions to FUs, (c) FU response time, (d) FU capability to provide desired effects, (e) Arbitrary, and (f) Other.

Measurement Information:

A. Decision time: A - B.

B. Decision Reason. C.

3. Priority of Targets by FDO:

Data Points:

A. Decision Start Time.

B. Decision End Time.

C. Decision reason: (a) Priority of fire in operations order (OPORD), (b) Priority established by commander's criteria (mission), (c) Priority determined by current situation, (d) Capability of FU, and (e) Other.

Measurement Information:

A. Decision time: A - B.

B. Decision Reason: C.

4. Generation of Target from S2 Intelligence Data:

Data Points:

A. Decision Start Time.

B. Decision End Time.

C. Decision reason: (a) Source or reliability of information, (b) Sufficiency of data, (c) Priority of target, (d) Intensity of conflict (current situation), (e) Target criteria, and (f) Other.

Measurement Information:

A. Decision time: A - B.

B. Decision Reason: C.

5. Determination of Forward Line of Troops:

Data Points: (by agency)

A. Decision Start Time.

B. Decision End Time.

C. Decision Reason: (a) Forward observers locations from FM:OBCO messages, (b) Radio traffic, (c) FSE coordination with maneuver units, (d) Requests, and (e) Other.

Measurement Information: (by agency)

A. Decision time: A - B.

B. Decision Reason: C.

6. Passing of Intelligence Information:

Data Points: (by agency)

A. Decision Start Time.

B. Decision End Time.

C. Decision Reason: (a) Importance of information to receiving station, (b) Intensity of conflict, (c) Established criteria or current orders, and (d) Other.

Measurement Information: (by agency)

A. Decision time: A - B.

B. Decision Reason: C.

7. Action taken by FSE to meet firing times on Fire Plans.

Data Points: If TOT is not on time or TOT is not fired obtain the following by FSE:

A. Event start time: Fire plan message time.

B. Decision start time.

C. Decision end time.

D. Type of Decision: (a) None, (b) Requested additional time from TF commander, (c) Notified Brigade FSE, (d) Tried to make time, (e) Requested assistance from FDC, (f) Requested instructor assistance, and (g) Other.

Measurement Information: (by agency)

A. Decision time: B - C.

B. Type of Decision: D.

8. Request for Delivery of Minefield by TF FSE:

Data Points: (by FSE)

A. Decision Start Time.

B. Decision End Time.

C. Decision: (a) None, (b) Forward to BDE FSE, (c) Forward to FDC, (d) Forward to S3, (e) Request assistance from instructor, and (f) Other.

Measurement Information: (by FSE)

A. Decision time: A - B.

B. Decision Reason: C.

9. Request for Airstrike by TF FSE:

Data Points:

A. Decision Start Time.

B. Decision End Time.

C. Decision: (a) None, (b) Forward to BDE FSE, (c) Forward to FDC, (d) Forward to S3, (e) Request assistance from instructor, and (f) Other.

Measurement Information:

A. Decision time: A - B.

B. Decision Reason: C.

10. Obtain Status of Fire Units:

Data Points: (by agency)

A. Reason for request: (a) Request by maneuver commander, (b) Planning for future operations, (c) Type of ammunition available, (d) Capability for specific mission, (e) Map update, and (f) Other.

B. Request made to: (a) FDC, (b) BDE FSE, (c) TF FSE, (d) Shooter, (e) Instructor, and (f) Other.

Measurement Information: (by agency)

A. Decision Reason: A

B. Decision Source: B

Programmer's Reference

In this section modifications made to the United States Army Field Artillery School's (USAFAS) Command Post Exercise (CPX) software are documented. Changes to the software (a) provide a message tracking capability which allows performance data to be collected and (b) dBASE IV reports summarizing the data to be generated.

The CPX software operates with two systems, each programmed in different languages. The software on the Intel 310, which is the file server, is written in C on a XENIX operating system, whereas the software on the PC network is written in Microsoft FORTRAN77 V3.31 on a MS DOS system. The changes to both the Intel XENIX and the PC MS DOS systems are as follows:

1. The Intel XENIX system software was modified to send all messages to the J-27 port on the Intel 310 for tracking purposes.

2. The CPX software was modified to track message actions through the scenario by tagging each message with unique message identification (ID) numbers.

3. The student and instructor FORTRAN programs (i.e., SMAIN and IMAIN) on the student PC stations were modified to process message tracking information.

4. The instructor program (i.e., IMAIN) was modified to store the message tracking information in data files on the instructor terminal.

In addition, a dBASE IV system was created to receive data from the modified instructor program and produce reports summarizing the data.

Tracking Messages with Header Information

Messages originating either from the scenario or from student players have a header that provides certain information about the message (e.g., its length, the time it was sent, who sent it, who received it, and what kind of message it was). The header is actually the first line, or first 80 columns, of the message. As this header travels with each message, the message tracking system uses it to carry information.

To implement the message tracking system, the header was modified so that more items of information could be captured from the messages. For example, data items such as the ID of the originator of the chain of messages, expected Time on Target (TOT), and the time the message being responded to was transmitted were added to the header. These items were added by modifying the scenario file in the Intel XENIX system and by

updating the FORTRAN routines on the PC MS DOS system. The modified header is shown in Table 7. The original data items of the header start with "message length in bytes" found in columns 1-4 and end with "field added when the message is forwarded: ID of the unit sending the message being forwarded" in columns 18-19. Data items added to the header start in column 58 "ID of the originator of the chain of messages" and end in column 74-77 "message ID of the originating message."

Table 7

Message Header Information

Column	Data Item
1-4	Message Length in bytes
5-8	The time the message was sent
9	A control-V character for verification
10-11	The Destination Unit ID
12-13	The Sending unit ID
14	Message Type Code
15	Flag indicating the message was read
16	Flag indicating that the message was printed
18-19	Field added when the message is forwarded: ID of the unit sending the message being forwarded
58-59	ID of the originator of the chain of messages
60-63	Expected Time on Target (TOT) or H-Hour for this Request for Additional Fire (RFAF)
64-67	Transmission time of previous message
68	Not used
69-72	Message ID for this message
73	Report Type Code
74-77	Message ID of the originating message

Impact of the Software Modifications on the CPX

The software modifications will affect the running of the CPX in two ways. First, when transmitting a message, student players must identify the message to which they are responding. To implement this tracking process, an additional prompt is presented to the players. When the player selects the option for sending a message, a list of previously received messages is displayed. The messages are numbered in the order in which they were received. Once students have typed in the message number corresponding to the message they are responding to, the message screen vanishes and they are returned to the appropriate screen to continue message preparation. For example, if a student receives a plain text message (PTM) that requests fire at a certain location, the student may then respond by initiating a Request for Additional Fire (RFAF) message. In order to track the response, the ID of the initiating plain text message must be known. Thus, the student is asked to provide the number of the message to which he is responding. It should be noted that for messages whose origin is clear, such as forwarded messages or End of Mission (EOM) messages generated from the RFAF screen, no prompt for the originating message is required.

The second effect of the software modifications involves the CPX hardware. The PC that houses the instructor program (i.e., IMAIN) must have a hard drive because the modifications will cause several hundred messages to be written to the disk during operation. Because the amount of space needed varies with the length of time the CPX is run, at least 3 megabytes (MB) additional disk space is recommended. dBASE IV must also be loaded onto this hard drive if reports are to be generated on-site.

In addition, particular attention must be given to the port assignments and port connections. The terminal selected to run the instructor program must be connected to the Intel's J-27 port. Because the instructor program now filters all messages not addressed specifically to the logged on player, the two-character code entered at the start of the PC program must match the assignment in the set-up files. Failure to meet these two requirements will cause the message tracking program to fail. For example, in the current CPX set-up, the instructor program is loaded on the S2 and S3 terminal. The code for that module is Z1. Therefore, the S2 and S3 terminal must be connected to the J-27 port of the Intel and the player must log on as Z1.

It is also recommended that the XENIX program be paused after the scenario is stopped to allow all players to respond to the messages remaining in their message queues. When the Intel XENIX system is set to pause, no new messages are sent, but players are allowed to respond to messages. If players are not allowed to respond, misleading response times may be produced by the Reporter Program.

Software Changes

There were five modifications of the original software:

1. The CPX Scenario file on the Intel XENIX system was modified to incorporate sequential message numbers and report flags in the header.

2. The XENIX CPX program was modified so that every message generated by the system or by the players is sent through the J-27 port of the Intel.

3. The SMAIN and IMAIN programs were modified to capture originating message information for student-generated messages. For example, when student players respond to a message, they are prompted for a message ID number that identifies what message they are responding to. The message ID number is used, by the system, to look up the message number of the originating message in the players' local message queue. This number is captured in global variable MSGID.

4. The IMAIN program was modified to trap incoming messages, save the header information to disk as a delimited ASCII file for inclusion into dBASE IV, and display only those messages addressed specifically to the Intel J-27 port.

5. A menu-driven dBASE IV report system was developed to load the data produced by the IMAIN program into data base files, which can then be used to produce reports summarizing the data.

In the sections that follow, changes made to the programs of the Intel XENIX and PC MS DOS systems are explained in detail. In addition, start-up instructions for the modified CPX PC and Intel programs are given in Appendix J.

The Intel XENIX System

The Intel XENIX system consists of a CPX C program and a CPX scenario file. Both were modified to add message tracking calls and information.

Modification of the CPX C program

Only one source file was modified in the CPX C program: "message.c". Specifically, changes were made to the process_message()[1] routine in the message.c file. Each message is written out twice, once to the addressee port, and once to the J-27 port. If J-27 is the addressee port, the message is only written once. The messages are written by calling the writeport() routine. Originally, each message was written only once to its addressee.

Modification of the CPX scenario file

Several changes were made to the scenario file. Unique identifiers for each message were placed in columns 74-77 of the message header. Each message ID is a four character number running sequentially from 0001 to 0446. These identifiers eventually become the ONUM (Origination Number) field of the HEADER table in the dBASE IV Reporter portion of the follow-up application. They are used to report player responses based on originating messages.

The only exception to this uniqueness exists in the headers of two messages sent at 0753 from "CO" (a position played by the computer scenario) to "F2." Both messages refer to the same fireplan, series DAVE, and therefore must be referenced as the same originating event. These messages are both numbered "0173."

Additionally , a report type character has been added in column 73. This report type character is a single character flag that provides consistent tracking for messages sorted by report type. This was changed so that plain text messages (PTMs), which can not be interpreted by the software could be identified as part of a chain of messages for a given report. This character becomes the "REPORTTYPE" field of the "HEADER" table of the dBASE IV Reporter portion of the follow-up application. The Reporter application uses this field to filter messages for individual reports.

Once a scenario or player message has been sent, the FORTRAN applications at each player node modify the header line for other purposes, but columns 73-77 remain intact.

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[1]The use of () following the name of a routine such as process_message() is a standard way to represent a subroutine.

Two additions were made to each message block in the scenario file: a message ID and a report flag. The message ID is a four character number running sequentially from 0001 to 0446. The report flag is a single character flag that provides consistent tracking for messages sorted by report type. This was changed so that plain text messages (PTM), which cannot be interpreted by the software, could be identified as part of a chain of messages for a given type of report.

The PC MS DOS System

The MS DOS system consists of two major programs, IMAIN.EXE and SMAIN.EXE, along with supporting ASCII and PANEL files. No modifications were made to the ASCII or PANEL files. However, the IMAIN.EXE and SMAIN.EXE FORTRAN programs were modified.

Modification of the IMAIN Program

Most of the message tracking modifications were done in IMAIN because it runs the module that actually captures and saves all of the message tracking information.

The IMAIN modification consisted of adding three major subroutines: GETMNM, SHOMSG, and AUDITR, along with some minor supporting ones. Each is described generally in the paragraphs that follow. For more detail, see the New Subroutines section of this report.

IMAIN Common Variables

Some of the message tracking information is gathered by different subroutines and kept in common variables. The new COMMON blocks for the message tracking are:

```
COMMON/AUDIT/MSGID,ORID,SDID,MCOUNT,MSGTIM,CRITFLAG
CHARACTER*4 MSGID,MSGTIM
CHARACTER*2 ORID,SDID
INTEGER*2 MCOUNT
CHARACTER*1 CRITFLAG

COMMON/DEBUG/FILENAME,HTILINE,DFLAG
CHARACTER*8  FILENAME
CHARACTER*4  HTILINE
CHARACTER*1  DFLAG

COMMON/DATE/DATEST
CHARACTER*9 DATEST
```

The variables in the AUDIT common block generally refer to items extracted from the last cited originating message. When the user is prompted to enter the number of the message requiring a response, that message's header is retrieved from the array and these items of information are extracted and held for the AUDITR() and SDMSG() subroutines to use.

MSGID. MSGID holds the message ID of the originating message. This is the four character ID from the scenario header or a user-generated ID. Message IDs from the scenario are integers, starting at 0001 for the first message and running to 0446. User-generated messages have a Message ID which is formed by concatenating the two letters of the user ID (e.g., F9) with a running message count. This count is maintained in MCOUNT. Thus, the second message generated by user F9 would have a MSGID of "F902".

ORID. This is the two-letter code indicating the identity of the user station that originated the message.

SDID. This is the two-letter code indicating the identity of the user station that sent the message.

MCOUNT. This is an integer variable that holds a running count of the number of messages that the user station has sent over the course of the exercise. It is used to form the sequential set of unique MSGID strings. See MSGID.

MSGTIM. This is the time stamp of the originating message that is used to compute the difference between the time stamp on the message being sent out and the time delay in response transmittal.

CRITFLAG. This flag, when set, indicates that a particular message refers to a critical event.

FILENAME. This variable is used in debugging and contains the name of the source code file which last called AUDITR(). This information is then placed in the ERROR.DAT file during the execution of the program to identify where the calls to AUDITR() originated.

HTILINE. Similar to "FILENAME", this variable is used in debugging and contains the line of the source code file which last called AUDITR(). This information is then placed in the ERROR.DAT file during the execution of the program to identify where the calls to AUDITR() originated.

IMAIN Data Output Files

The IMAIN program produces two output files that are ASCII loader files for the dBASE Report System, HEADER.DAT and AMMO.DAT. The IMAIN program also produces a debug file, ERROR.DAT, used during software development to trace calls to the subroutine AUDITR(). This output file is not used in the actual running of the CPX, and will not be described in detail. In fact, it can be deleted, if desired.

HEADER.DAT. HEADER.DAT includes most of the audit information extracted from the message headers. A record in HEADER.DAT is generated from every message received by the instructor program in the subroutine AUDIT(). It is structured as a dBASE loader file. Thus, fields are comma delimited, and character fields are further delimited by a pair of double quotes. The default structure of the record is:

"MNUM","ONUM","TIME","TGTNUM","TGTCOR","OR","SE","RE","C",MIN, RES,"D",TOT,"HOUR".

Table 8 shows the fields and field definitions of HEADER.DAT. For example, MNUM, a globally defined variable, refers to the message number that uniquely identifies the message and TIME refers to the time that a message was sent. Note that the field C of HEADER.DAT refers to the type of message code used by the software. For example, as seen in Table 9, a Message Type Code of 5 corresponds to ATI;CDR (artillery intelligence information), whereas a code of 6 corresponds to ATI;SHR (shell report).

AMMO.DAT. AMMO.DAT contains information on the ammunition usage. Fields are comma delimited, and character fields are further delimited by a pair of double quotes. The default structure of the record is:

"FIRUNIT",RD,"SHEL","FUZE","TGTNUM","TGTCOR",F,"RE","ONUM","SE" .

Table 10 shows the fields and field definitions of AMMO.DAT. As seen in this table, FIRUNIT refers to the ID of the firing unit and RD refers to the number of ammunition rounds fired.

Table 8

HEADER.DAT Message Fields

Field	Code	Field Purpose
MNUM	4C	Message Number uniquely identifying this message
ONUM	4C	Originating Message Number
TIME	4C	Time this message was sent
TGTNUM	6C	Target Number
TGTCOR	6C	Target Coordinates (Easting + Northing)
OR	2C	ID of Originator
SE	2C	ID of Sender
RE	2C	ID of Receiver
C	1C	Message Type Code
MIN	3N	Number of minutes past start of exercise
RES	3N	Number of minutes this response took
D	1C	Flag keying the report type
TOT	3N	Minutes past TOT time
HOUR	4C	Time of the original message

Table 9

Message Type Codes for Field C of HEADER.DAT

Code	Name	Message Purpose
1	SPRT;FIRE	Schedule of Fires
2		Quick Fireplan (not used)
3	AFU;BAMOUP	Fire Unit Ammo Status
4	AFU;UPDATE	Fire Unit Information Update
5	ATI;CDR	Artillery Intelligence Information
6	ATI;SHR	Shell Report
7	FM;EOM	End of Mission Report
8	FM;RFAF	Request for Fire Mission
9	FM;OBCO	Friendly Observer Location
A	SYS;PTM	Plain Text Message
B	SYS;SUBS	Subscriber Table
C	SPRT;TGT	Target List
D	SPRT;GEOM	Fire Support Boundaries
E	SPRT;AIR/NGF	Tactical Air and Naval Gun Fire Request

Table 10

AMMO.DAT Message Fields

Field	Code	Field Purpose
FIRUNIT	8C	Firing Unit ID
RD	2N	Number of Ammunition Rounds Fired
SHEL	4C	Shell Type
FUZE	4C	Fuze Type
TGTNUM	6C	Target Number
TGTCOR	6C	Target Coordinates
F	1N	Was Target Fired? (1=True, 0=False)
RE	2C	Who Received Message
ONUM	4C	Where Message Originated
SE	2C	Who Sent Message

New Subroutines

Subroutine GETMNM(). A call to GETMNM() prompts the user to enter an integer number corresponding to the number of the message that is being responded to. For example, students may receive a PTM prompting them to issue an RFAF. When they call up the RFAF screen, they are presented with a prompt to enter the number of the message being responded to from a numbered list of messages that have been sent. They pick the number from the list, hit Return, and the RFAF panel data input screen appears.

GETMNM() gets the input from the user, uses the number to index into the message array, extracts the Message ID of the original message, and retrieves the header from that message. From the header, GETMNM() extracts the necessary information needed to track the response and places these values in global variables to be used when the message is sent out. GETMNM() is found in its own separate file GETMNM.

Subroutine AUDITR(OLMNUM). AUDITR(OLMNUM) processes new messages, stores information from legitimate messages in the files HEADER.DAT and AMMO.DAT, and filters messages so that only those addressed to the instructor terminal appear on the instructor screen. The player is unaware that the incoming messages are being processed except for a slight flicker of the screen header line each time a message is processed. The general processing done by AUDITR() is as follows:

1. AUDITR() checks to make sure that a valid message is being passed by looking at the 9th character in the header. If the character is a Control-V, then the message is valid and the program continues to process the message. If the character is not a Control-V, the message is not a valid message but rather a system generated message such as an acknowledge token. In that case, AUDITR() does not process the message and returns immediately with no additional action.

2. AUDITR() cycles through the set of messages received since the last call to AUDITR(). Each call to AUDITR() is proceeded by initialization of OLMNUM and a call to GTMSG() which actually retrieves one or more messages from the message buffer, updating MNUM in the process. The sequence looks like this:

```
OLMNUM = MNUM
CALL GTMSG()
FILENAME = 'IMAIN'
HTILINE = '188'
IF (MNUM .GT. OLMNUM) CALL AUDITR(OLMNUM)
OLMNUM = MNUM
```

A call to GTMSG() will result in zero if there are no new messages. Otherwise, new messages are placed in the ARRAY and the number of messages is updated if the new message count is nonzero. Thus, any call to GTMSG() that results in one or more new messages being retrieved from the communications buffer will increment MNUM such that it no longer equals its previous value as stored in OLMNUM. This causes the IF statement to call AUDITR(), passing the old value of MNUM(OLMNUM).

On entry to AUDITR(), the difference between MNUM and OLMNUM represents the number of messages that need processing. Each is processed in turn, the output data extracted from the header or calculated, and the output records written for HEADER.DAT and AMMO.DAT. The present configuration also writes a record to ERROR.DAT to use in debugging. This may be commented out or removed when no more changes are envisioned.

Subroutine SHOMSG(). This subroutine was derived from the original code used to list messages to the screen. When called, it lists the single line headers of the messages in the queue and adds a prompt to the user to select the message that is being responded to. When the user responds correctly with the queue number of one of the messages, the screen clears and the subroutine is exited.

Modification of the SMAIN FORTRAN Program

Modification of SMAIN, the program used by the students, consisted of adding calls to the GETMNM() routine. This links each new message to the previous message. These calls were placed in the following files:

1. SMAIN.FOR.
2. ENTROUT.FOR.
3. EXEC.FOR.
4. SSENDM.FOR.
5. SAUDIT.FOR.

The last file, SAUDIT.FOR, contains a single function, AUDITR(), which does nothing. The function, however, appears in many of the common files used by SMAIN and IMAIN, and saves message tracking information to disk. Since the student program does not save message tracking information, the dummy AUDITR() linked to SMAIN in SAUDIT.OBJ simply returns control to the calling function. By setting up the dummy function, changes could be made to single copies of the common files rather than maintaining one copy for SMAIN and another for IMAIN.

Compiling and Linking the FORTRAN Programs

To reduce the large number of copies of the same source code files found in the original implementation, the code development was partitioned into three separate subdirectories:

1. All files pertaining only to SMAIN are in the SMAIN subdirectory.

2. All files pertaining to IMAIN and all source files common to both SMAIN and IMAIN are in the IMAIN subdirectory.

3. All object files produced by the compilation are in the FORTRAN subdirectory.

Both the IMAIN and SMAIN subdirectory use a batch file to control compilation.

Compiling SMAIN. Compiling SMAIN is accomplished through the batch file CS.BAT located in the SMAIN subdirectory along with the source code files. A listing of CS.BAT is found in Appendix K. To compile a single source code file, type "CS filename", where the filename is the name of the source code file without the .FOR extension. For example, to compile the file EXEC.FOR, type

"CS EXEC" .

Linking SMAIN. Linking SMAIN is accomplished through LS.BAT. A listing of LS.BAT is found in Appendix K. Linking occurs in the FORTRAN subdirectory, which contains all of the object files. To link SMAIN, type:

"LS" .

Note that the common files are in the IMAIN subdirectory. If you change a common file (e.g., SDMSG.FOR) and compile it, the resulting object file (e.g., SDMSG.OBJ) will be in the FORTRAN subdirectory. To relink and produce a new version of SMAIN, you must then run LS. It is easy to forget to relink SMAIN when you are working on IMAIN and modifying one of the common files.

Compiling IMAIN. Compiling IMAIN is accomplished through the batch file CI.BAT located in the IMAIN subdirectory along with the source code files. Use of CI.BAT is the same for IMAIN as CS.BAT is for SMAIN. To link IMAIN type:

"CI" .

Linking IMAIN. Linking IMAIN is accomplished through LI.BAT. Use of LI.BAT is the same for IMAIN as LS. BAT is for SMAIN. Linking occurs in the FORTRAN subdirectory, which contains all of the object files. To link IMAIN, type:

"LI" .

The Reporter Program

The Reporter program, written in dBASE IV version 1.1, is a reporting and reviewing application that is run after completion of the CPX (see Appendix L). The program uses the two data files, HEADER.DAT and AMMO.DAT, created during the execution of the CPX. To run Reporter, these files must be loaded into the computer where the dBASE IV Reporter is housed. It is also necessary to know which PC is used as the instructor terminal. Therefore, the location of the instructor terminal should be verified by CPX personnel conducting the exercise. If the Reporter does not reside on the instructor terminal, the files should be copied onto a 5.25 inch floppy disk and transferred to the computer where the Reporter program is installed. Specifically, they must be copied into the appropriate subdirectory of the Reporter program. See Appendix L for additional instructions.

Setup User Information

At the DOS prompt, typing "Reporter" or running "C:\> dBASE reporter" will load dBASE and start the application. "Reporter" is fully menu driven; using the arrow keys and <return> will run any of the reports or allow browsing/editing of the raw data. The reports are designed to trace differing types of player activity based on originating scenario messages. See Appendix M for examples of the reports generated by the dBASE program.

Programming Background

Two ASCII delimited files serve as the input to the Reporter application. These are output by IMAIN.EXE as the CPX runs. Expected input comes from the HEADER.DAT and the AMMO.DAT files. These ASCII delimited files are imported into two dBASE tables "HRAW" and "ARAW". They are imported during application initialization, and remain static throughout program execution. One of these tables is read each time a report is requested. The selection of the table to be read depends on the report executed.

When a report is run, the contents of either "HRAW" or "ARAW" are read, and sorted and filtered into another table, either "HEADER" or "AMMO". These tables are used for the actual reporting (see Tables 11 and 12 for the structure of the Header and ARAW and AMMO tables, respectively).

Table 11

Structure of Header Table

Field	Name	Type	Width	Description
1	MNUM	Character	4	Message Number: The unique identifier for this message
2	ONUM	Character	4	Originator Number: The identifier for the originating message.
3	TIME	Character	4	Time sent
4	TGTNUM	Character	6	Target Number
5	TGTCOR	Character	6	Target Coordinates
6	OR	Character	14	Originator ID: Series or Plan Name is Sometimes substituted (see Reporter.prg)
7	SE	Character	2	Sender Id
8	RE	Character	2	Receiver Id
9	C	Character	12	Type of Message: Substituted at startup (see Reporter.prg)
10	MIN	Numeric	3	Minutes since startup
11	DELTA	Numeric	3	Response time delta for this message
12	REPORTTYPE	Character	1	Report Type: Used as filter to determine which report to be listed
13	HDELTA	Numeric	3	Time past H-Hour fired
14	HHOUR	Character	4	Time to be fired
** Total **			69	

Number of data records: 140

Date of last update: 09/14/90

Table 12

Structure of ARAW and AMMO Tables

Field	Name	Type	Width	Description
1	FUNIT	Character	8	Firing Unit Id
2	ROUNDS	Numeric	2	No. Rounds to be fired
3	SHELL	Character	4	Shell Type
4	FUZE	Character	4	Fuze Type
5	TGTNUM	Character	6	Target Number
6	TGTCORD	Character	6	Target Coordinates
7	F	Numeric	1	Fired? True = 1, False = 0
8	RE	Character	2	Message Receiver
9	ONUM	Character	4	Originator
10	SE	Character	2	Sender
** Total **			40	

Number of data records: 29

Date of last update: 09/14/90

APPENDIX A

DESCRIPTION OF TACFIRE MESSAGES USED IN THE CPX

This appendix gives the primary use of the TACFIRE formats identified from the FA CPX message printouts and the computer program menus that are used in the CPX play and generated by the software.

1. SYS; SBT (Operating system message - Subscriber table)

a. Lists system subscribers and shows unit designation and TACFIRE address. This will be the first message generated by the computer to start the exercise. Each subscriber (section) must be listed in the subscriber table and enter the subscriber table in order to communicate.

b. Allows for input, deletions, or changes to the identity and status of all subscribers. This is done by the TACFIRE control station which is normally DIVARTY headquarters and is played by the computer or control personnel during the exercise.

2. SPRT; TARGET LIST (Support program - Target list)

a. Lists targets that have been included or will be considered for fire planning. Can be passed down from higher headquarters or created by players. Usually a product of the Task Force (Battalion) FSE.

b. Contains items such as target locations and descriptions, firing time, priority, required and actual effects or volleys, firing unit, shell, fuze, number of rounds, and on-call or scheduled. How many elements depends upon stage of planning. Initial list may have only target number, location, and description.

3. SPRT; FIRE SCHEDULE (Support program - Fire schedule)

a. Used to create Fire plan, series, or group. Contains fire unit, target number, number of rounds, and time on target.

b. Targets from the Target Lists are used and is usually a produced by the FSEs.

4. SPRT; GEOM (Support program - Geometry)

a. Used to create boundaries and fire control measures.

b. Generated only by the Brigade FSE in this CPX.

5. SYS; PTM (System program - Plain Test Message)

a. Message sent in plain text in TACFIRE format.

b. PTM does not automatically start an action, but must be initiated by a TACFIRE operator at some location.

6. FM; RFAF (Fire mission - Request for Additional Fire)

a. A fire mission request which automatically generates gun commands. It can be an initial request for fire or for additional fire from the same firing unit or others.

b. Initiated by the Forward Observer, FSE, S2, or by the FDC. If a fire mission request is received as a PTM it must be changed to a FM:RFAF before sending it to the FU in this CPX.

c. Automatic fire unit assignment and firing commands can be overridden by the Fire Direction Officer.

7. FM; OBCO (Fire mission - Observer location)

Used to enter observer location. This is a major indicator of the front line of troops in the exercise.

8. ATI; SHR (Artillery Target Intelligence - Shell report)

To provide data to determine enemy location based on shell craters. Can be included in target list for planning or fired immediately.

9. ATI; CDR (Artillery Target Intelligence - Coordinate report)

Defines the location of a target by grid or geographic coordinates and the characteristics of the target. Primarily used for fire planning or the counterfire program rather than immediate firing.

10. AFU; UPDATE (Artillery Fire Unit - Update)

Used to update firing unit locations, status, and weapons strength.

11. AFU; BAMOUP (Artillery Fire Unit - Ammunition Update)

Used to establish ammunition data for the fire unit and fire unit planning files. Gives status of fire unit ammunition including fuzes, powder, projectiles, and lots.

APPENDIX B

CRITICAL EVENTS OF THE USAFAS CPX

This list contains the events that were determined critical to accomplish the objectives of the CPX. They are based upon (a) the importance of fire support planning and (b) supporting the maneuver plan of operation.

Event	Factor	Sections involved	Time
Series Arthur	Time fired 0640	F5, T1, Z2	0618
Group C1C	Time fired 0638 Request add. time	F7, T1, Z2	0632
Group C2C	Time fired 0710	F2, T1, Z2	0651
Series Bill	Time fired 0705	F3, T1, Z2	0653
Tgt CC4400	Time fired $$$$$	F5, T1, Z2	0723
Plan Chuck	Time fired 0745	F7, T1, Z2	0734
FASCAM update	Request	F3, T1	0742
Series Dave	Time fired 0802	F2, T1, Z2	0753
CC5006	Time check fire	F7, T1, Z2	0753
Cancel tgts	Time	F7, T1, Z2	0800
Airstrike request	Time, action	F5, F9	0803
Dead FSO	Action	F5, Z1	0812
CC5106 FFE	Time	F7, T1, Z2	0823
Plan Eric	Time fired 0845	F3, T1, Z2	0828
Plan Fred	Time fired 0855	F2, T1, Z2	0835
Series Greg	Time fired 0900	F7, T1, Z2	0841
CC2004 on call	Action	F2, T1	0847
Group C4C	Time fired 0935	F3, T1, Z2	0922
Group C5C	Time fired 0940	F3, T1, Z2	0922

Event	Factor	Sections involved	Time
Cancel tgts 4010,4011,4012	Time, action	F5, T1, Z2	0927
Group C6C	Time fired 0940	F7, T1, Z2	0928
Series Hank	Time fired 0945	F7, T1, Z2	0928
Cancel tgts 4020,4021,4022	Time, action	F5, T1, Z2	0932
Series Ivan	Time fired 1005	F2, T1, Z2	0950
Cancel tgts	Time, action	F7, T1, Z2	0950
Check firing	Time, action	F2, T1, Z2	1012
Big Joe	Time, action	F5, T1, Z2	1034
Air strike	Time, action	F7, F9	1043
FASCAM	Action	F7, F9	1049
Arty fire on mine field	Time, action	F5, T1, Z2	1057
FM:CC4016 FPF	Time	F5, T1, Z2	1105

APPENDIX C

CPX DECISIONS

This appendix shows the major decisions that are required during the CPX and the criteria used to make the decision.

S2 Decision to fire on targets identified by means other than direct observation (ATI) - Criteria: (a) Source of information, (b) Reliability of source, (c) Priority of target, and (d) Intensity of conflict (current situation).

S2 Location of targets from Shell Reports - Criteria: (a) Sufficient intercepting radials of similar caliber, and (b) Timeliness of last report.

S3 Move Firing Units - Criteria: (a) Maintain enough FUs in action to support maneuver forces, (b) Maintain FUs in range, (c) Maintain support for future actions and plans, (d) Degree of threat to FU, and (e) Coordination with supported force.

S3 Move ammunition between FUs - Criteria: Maintain equal distribution of ammo based on (a) Current situation, (b) Planned missions and Operations, and (c) Contingency plans.

FDO Number of rounds to fire on targets - Criteria: (a) Destroy or neutralize the target, and (b) Satisfy the weapons effects criteria.

FDO Which FUs to fire on targets - Criteria: (a) FU within range, (b) Distribution of missions to FUs, (c) FU response time, and (d) the capability of the FU to provide the desired effects.

FDO Priority of targets - Criteria: (a) Priority of fire in OPORD, (b) Priority established by commander's criteria, and (c) Priority determined by current situation.

FDO Determine coordinates of target from Target Number - Criteria: Obtain coordinates from current target list.

FDO Fire Fire Plan on time - Criteria: (a) Receive request on time, (b) Fire in accordance with Fire Plan, and (c) Rounds impact + or - 3 seconds of TOT.

FDO Insufficient time to plan and fire fire plan - Criteria: (a) Notify maneuver element for addition time, and (b) Consider alternate support method.

FSO Build target list, identify targets - Criteria: (a) Known enemy locations, (b) Possible enemy locations that might

influence the plan, (c) Terrain features, and (d) Targets requested.

FSO Counterattack support - Criteria: (a) Fire plan supports plan, and (b) Adequate support.

FSO Determine Forward Line of Troops (FLOT) - Criteria: Plot current location of observers.

FSO Cancel fire - Criteria: (a) Request from appropriate agency, (b) Current situation, (c) Determine target numbers to cancel, and (d) Timely request to FDC.

FSO Fire Fire Plan on time - Criteria: (a) Forward to FDC in sufficient time to accomplish in accordance with plan, (b) Take action if insufficient time, and (c) Query to remind FDC.

FSO Artillery delivery of minefield - Criteria: (a) Request by maneuver commander, and (b) Current policy of higher HQ.

FSO Air strike request - Criteria: (a) Request by maneuver commander, and (b) Forward through Brigade channels by Bde FSO.

FSO Plan Final Protective Fires - Criteria: (a) Request by maneuver commander (FSO), and (b) Forward to FDC.

FSO Maintain status of fire support agencies - Criteria: Obtain (a) location, (b) missions, (c) capabilities, (d) ammo status, and (e) degrees of exposure to NBC.

All Passing of intelligence or tactical information - Criteria: (a) Importance of information to receiving station, (b) Intensity of conflict, and (c) Established criteria or current orders.

APPENDIX D

MEASUREMENT ITEMS

FM:RFAF or PTM generated FM

1. Time received by the FSE (F*) - Program message time. Time is not recorded if initial message is sent directly to T1.
2. Time received by the FDC (T1) - Program message or player time.
3. Time sent to the Shooter (Z2).
4. Time fired by Z2.
5. Did the fire request meet mission criteria for 20% offensive targets?
6. Did the FDC enter coordinates if they were not given in the RFAF?

FIRE PLAN (SERIES OR GROUP)

1. Time received by the FSE (F*).
2. Time sent to the FDC (T1).
3. Time fired by Z2.
4. Was it fired on time?
5. Did the fire request meet mission criteria for 20% offensive targets?
6. Did the FSE query the FDC as to the status of the fire plan prior to firing?
6. If unable to fire on time did the FSE take any action?

PTM: Cancel targets.

1. Time the request was received by the FSE - Program message.
2. Time the FDC was notified.
3. Time Z2 was notified.
4. Were all targets cancelled?

Battery Movement Time - Length of time out of action

1. Time out - from AFU:UPDATE message time - from T1/Z2.
2. Time in - from AFU:UPDATE message time - from T1/Z2.
3. Alternate method - from PTMs T1/Z2.

Amount of Ammunition shot by FU

1. Ammunition as requested by an FM:RFAF.
2. Confirmed by (EOM:X) in RFAF, or FM:EOM.

Number of Missions Passed to Each FU

1. FM:RFAF sent by T1 shows the FU.

2. Confirmed by (EOM:X) in RFAF or FM:EOM.

Effects of Fire - Enough rounds to destroy the target?

Compare the number of rounds in the FM:RFAF with the weapons effects criteria.

Fires out of Zone

1. Determine the zone by SUPT:GEO messages from the FSEs.
2. Coordinates of FMs from the FM:RFAF by T1.

Preparation (Fire Plans, Series, etc.) Firing Data

1. Targets from the Fire Plan List.
2. Time from the first target to the last target (FM:RFAF - EOM).
3. Time each target was fired (FM:RFAF - EOM).
4. Amount of ammunition fired from the FM:RFAF.

Counterattack Information

1. Fire Plans generated to support the counterattack (Fire Plan Data).
2. Number of Fire missions (FM:RFAF - EOM).
3. Location of FM (Coordinates from FM:RFAF.

Number of Rounds vs. Missions Requested by FSO

1. Number (and target number) of FM:RFAF sent by the FSE.
2. Number of these missions fired determined from the EOM data.
3. Total number of rounds from these missions (FM:RFAF).

Number of Targets purged from the Target List

1. Collected from keyboard action at each node.
2. Total number of targets purged from the system by each section.

Number of Missions Sent to a Moving Battery

1. Use the FM:RFAF EOM time as shooting time.
2. Time out or in from AFU:UPDATE message.

Action Taken by FDO to Meet Firing Times

1. Identify prior missions.
2. Video event (Start at message time).

APPENDIX E

CPX FIRE MISSIONS

This list contains fire missions generated by the scenario by an FM:RFAF message. It does not contain FMs generated by PTM, CDR, or SHR.

FIRE MISSION #	SECTION	TIME	
CC4001	F5	0603	
CC4002	F5	0607	
CC5001	F7	0620	
CC5101	F7	0624	
CC2201	F2	0633	
CC3200	F3	0641	
CC3201	F3	0643	
CC2003	F2	0644	
CC3203	F3	0646	
CC3003	F3	0726	
CC5103	F7	0728	
CC3103	F3	0730	
CC5006	F7	0731	Critical Event
CC3004	F3	0735	
CC2103	F2	0745	
CC2203	F2	0748	
CC5200	F2	0756	
CC2302	F2	0807	
CC3104	F3	0808	
CC2104	F2	0815	
CC5106	F7	0820	
CC3105	F3	0821	
CC5106	F7	0832	
CC4009	F5	0840	
CC4037	F5	0852	
CC4013	F5	0854	
CC4022	F5	0905	
CC4011	F5	0909	

FIRE MISSION #	SECTION	TIME	
CC4030	F5	0913	
CC3204	F3	0916	
CC4040	F5	0917	
CC3005	F3	0919	
CC2207	F2	0926	
CC3204	F3	0930	
CC2005	F2	0942	
CC2208	F2	0945	
CC5208	F7	1015	
CC3208	F3	1023	
CC4014	F5	1038	
CC3206	F3	1041	
CC4027	F5	1042	
CC2007	F2	1045	
CC2110	F2	1050	
CC4015	F5	1050	
CC3309	F3	1104	
CC4016	F5	1105	Critical Event
CC2109	F2	1109	
CC5012	F7	1114	
CC4024	F5	1118	

APPENDIX F

CPX ATI FIRE MISSIONS

This list contains Fire Missions generated by messages other than FM:RFAF. DY targets, targets received from V2 (Radar), or targets received by ATI;CDR message are radar generated.

GRID/TGT #	TIME	TO:	FROM:	REMARKS	ROUNDS
011271	0607	T1	V2	PTM:FFE	10
005288	0612	Z1	V2	PTM	1
974269	0618	Z1	V2	PTM	4
DY4001	0618	Z1	F9	ATI:CDR/G2 - SLAR/AR	12
DY4002	0618	Z1	F9	ATI:CDR/G2 - SLAR/AR	12
DY4003	0618	Z1	F9	ATI:CDR/G2 - SLAR/AR	8
005288	0620	Z1	V2	PTM	1
007210	0620	Z1	V2	PTM	6
005288	0629	Z1	V2	PTM	10
019238	0634	Z1	V2	PTM	8
987285	0638	Z1	V2	PTM	5
009195	0639	Z1	V2	PTM	6
010285	0645	Z1	V2	PTM	1
DY4004	0654	Z1	F9	ATI:CDR/G2 - SLAR/FROG	
DY4005	0654	Z1	F9	ATI:CDR/G2 - SLAR/FROG	
CC3203	0658	T1	F3	REPEAT TARGET	
DY4006	0659	Z1	F9	ATI:CDR/G2 - SLAR/FROG	
045208	0659	T1	V2	PTM:FFE	6
DY4007	0722	Z1	V2	ATI:CDR	6
CC4400	0723	T1	F5	OP/Critical Event/SMOKE	
DY4008	0729	Z1	V2	ATI:CDR	1
DY4009	0733	Z1	V2	ATI:CDR	5
DY4010	0735	Z1	V2	ATI:CDR	1
DY4011	0741	Z1	V2	ATI:CDR	6
DY4012	0746	Z1	V2	ATI:CDR	10
DY4013	0756	Z1	V2	ATI:CDR	6
DY4014	0807	Z1	V2	ATI:CDR	10
DY4015	0810	Z1	V2	ATI:CDR	10

GRID/TGT #	TIME	TO:	FROM:	REMARKS	ROUNDS
DY4016	0816	Z1	V2	ATI:CDR	6
CC5106	0823	T1	F7	OP/Critical	Event
DY40017	0824	Z1	V2	ATI:CDR	6
DY4018	0829	Z1	V2	ATI:CDR	4
DY4019	0830	Z1	V2	ATI:CDR	8
DY4020	0847	Z1	V2	ATI:CDR	4
DY4021	0855	Z1	V2	ATI:CDR	6
DY4022	0901	Z1	V2	ATI:CDR	5
DY4023	0905	Z1	V2	ATI:CDR	3
DY4024	0909	Z1	V2	ATI:CDR	4
DY4025	0913	Z1	V2	ATI:CDR	10
DY4026	0918	Z1	V2	ATI:CDR	5
956177	0925	Z1	G1	PTM:SHR	10
DY4027	0947	Z1	V2	ATI:CDR	6
DY4028	0956	Z1	V2	ATI:CDR	4
DY4029	0959	Z1	V2	ATI:CDR	1
DY4030	0959	Z1	V2	ATI:CDR	6
DY4031	1007	Z1	V2	ATI:CDR	8
DY4032	1011	Z1	V2	ATI:CDR	4
DY4033	1011	Z1	V2	ATI:CDR	8
DY4034	1011	Z1	V2	ATI:CDR	4
DY4035	1018	Z1	V2	ATI:CDR	4
DY4036	1023	Z1	V2	ATI:CDR	6
DY4037	1025	Z1	V2	ATI:CDR	10
DY4038	1030	Z1	V2	ATI:CDR	4
DY4039	1031	Z1	V2	ATI:CDR	5
DY4040	1034	Z1	V2	ATI:CDR	6
DY4041	1034	Z1	V2	ATI:CDR	6
DY4042	1034	Z1	V2	ATI:CDR	4
DY4043	1039	Z1	V2	ATI:CDR	6
DY4044	1039	Z1	V2	ATI:CDR	8
DY4045	1044	Z1	V2	ATI:CDR	4
DY4046	1044	Z1	V2	ATI:CDR	8

DY4047	1044	Z1	V2	ATI:CDR	10
GRID/TGT #	TIME	TO:	FROM:	REMARKS	ROUNDS
DY4048	1055	Z1	V2	ATI:CDR	6
DY4049	1055	Z1	V2	ATI:CDR	4
044165	1057	T1	F5	Critical Event	
DY4050	1100	Z1	V2	ATI:CDR	4
DY4051	1100	Z1	V2	ATI:CDR	5
DY4052	1106	Z1	V2	ATI:CDR	5
DY4053	1106	Z1	V2	ATI:CDR	6
DY4054	1112	Z1	V2	ATI:CDR	4
DY4055	1112	Z1	V2	ATI:CDR	6
DY4056	1112	Z1	V2	ATI:CDR	4
DY4057	1122	Z1	V2	ATI:CDR	10
DY4058	1122	Z1	V2	ATI:CDR	10
DY4059	1127	Z1	V2	ATI:CDR	7

APPENDIX G

TARGETS GENERATED BY SHELL REPORTS

This is a list of the targets identified by shell reports that meet the criteria of a target as defined in the CPX operations order.

1. Target at coordinates 973853 identified as possible target by ATI;SHR message at 0631. Target rays identify 130mm and unknown caliber. Out of sector to north. Requires coordination with DIVARTY.

   ATI;SHR at 0634 from B5 (FO) identifies target by 3 rays.

   ATI;SHR at 0727 from B5 (FO) additional verification of target.

2. Target at coordinates 055110 identified by ATI;SHR from A5 (FO) at 1013 (3 rays 122mm south of sector). Requires coordination with DIVARTY.

3. Possible target at approximate coordinates 170195 at 1015 by ATI;SHR from C7 (3 rays 122mm south of sector, angle very small). Requires coordination with DIVARTY.

APPENDIX H

FIRE PLANS

FIRE PLAN	H-HOUR	TARGETS	REMARKS
Series Arthur Received 0618	0640	CC4101 CC4100 CC4001 CC4002	Engage at H Hour One minute between engagement of each target
Group C1C Received 0632	0638	CC5001 CC5002 CC5101	Engage all tgts at H Hour, (Not enough time to process fire plan)
Group C2C Received 0651	0710	CC2003 CC2200 CC2300	Simultaneous engagement at H Hour
Series Bill Received 0653	0705	CC3201 CC3200 CC3203	Engage at H Hour One minute between engagement of targets
Plan Chuck Received 0734	0745	CC5005 CC5103 CC5006	H - H+2 H - H+3 H+8 - H+11
Series Dave Received 0753	0802	CC2301 CC2103 CC2203 CC2302	Engage at H Hour. Two minutes between engagement of tgts On call target
Plan Eric Received 0828	0845	CC3105 CC3300 CC3301 CC3302	Engage H - H+2 H+3 - H+5 H+6 - H+8 H - H+8
Plan Fred Received 0835	0855	CC2105 CC2206 CC2303 CC2106	Engage H - H+2 Bn Mortar H - H+2 H+4 - H+7 H+9 - H+11

FIRE PLAN	H-HOUR	TARGETS	REMARKS
Series Greg Received 0841	0900	CC2105 CC2206 CC2303 CC2106	Engage H - H+2 Bn Mortar H - H+2 H+4 - H+7 H+9 - H+11
Group C4C Received 0922	0935	CC3204 CC3005 CC3305	Simultaneous engagement at H Hour with maximum rate of fire
Group C5C Received 0922	0940	CC3303 CC3304	Simultaneous engagement at H Hour with sustained rate of fire
Group C6C Received 0928	0940	CC5201 CC5202 CC5203	Simultaneous engagement at H Hour
Series Hank Received 0928	0945	CC5113 CC5112 CC5114	Engage at H Hour with one minute between initial engagement of each target
Series Ivan Received 0950	1005	CC2005 CC2208 CC2304 CC2305 CC2306	Engage at H Hour H Hour H Hour H+3 H+6

APPENDIX I

OFFENSIVE POSTURE FOR TARGETS--20%

Casualties	Target Size (meters)	1 plt	155mm 1 btry	how. 2 btry	volleys 1 bn	2 bn
20%	50	6	2	1	1	E
	100	12	3	2	1	E
	150	12	3	2	1	E
	200	12	4	2	1	E
	250	15	6	3	2	1
	300	P	7	4	3	1
	350	P	9	5	3	2

E = Excessive damage for 1 volley
P = Prohibitive number of volleys for desired effect

This table is part of the CPX information available to the students. It is stored in the computer files and is accessible on the menu.

APPENDIX J

CPX PROCEDURE NOTES

Begin by starting the Personal Computer (PC) program.

1. Turn on PC.

2. At C:\>, type **cpx <ENTER>**.

3. Information will be presented on the screen. When ready, at C:\CPX>, type **start <ENTER>**.

4. On the screen will be displayed:

   ENTER 2 CHARACTER MESSAGE ADDRESS.

   Enter the code for the position you are playing. For example, if you are the Battalion Fire Direction Center, type **T1 <ENTER>**. The codes for the seven remaining positions are:

   Z1 for the Battalion S2
   Z2 for the Battalion Shooter
   F9 for the Brigade Fire Support Element (FSE)
   F2 for the Task Force (TF) 3-2 FSE
   F3 for the TF 3-3 FSE
   F5 for the TF 3-25 FSE
   F7 for the TF 3-77 FSE

   (NOTE: All codes start with a capital letter and end with a number. Make sure you enter the code exactly as it is given to you.)

   If the code is correct, type **Y <ENTER>** at the verification prompt. If the code is incorrect, type **N <ENTER>** and you will be re-prompted for the 2 CHARACTER MESSAGE ADDRESS.

5. Next, you will be asked if a printer is attached. If you type **Y <ENTER>**, all of your messages will be printed.

Once all terminals are on-line, start the Intel CPX program.

1. Turn on the Intel machine.

2. If **Proceed with cleaning?** is displayed, type **Y <ENTER>**.

3. At **login:** prompt, type **cpx <ENTER>**.

4. At **Password:** prompt, type the current password and then press **<ENTER>**.

5. At **1%** prompt, type **cpx <ENTER>**.

   The system will initialize and the screen will begin to scroll. Press the space bar to stop and show the menu.

6. Type **s** to start the scenario.

7. When you are ready to stop the CPX session, it is recommended that the scenario be paused for some time to allow all players to respond to the messages in their message queues. To pause the scenario, press the space bar to stop and show the menu. Then type **p**.

8. After all players have processed their messages, you can exit the program by typing **q**.

APPENDIX K

CPX SYSTEM BATCH FILES

1. CS.BAT

CS.BAT links a single SMAIN source file:

```
copy %1.for \fortran
cd \fortran
for1 %1,%1,nul,nul > \cpx\smain\err
pas2
cd \cpx\smain
```

2. LS.BAT

LS.BAT links SMAIN. Its listing is as follows:

```
cd \fortran
link @smain.lnk
exepack smain.exe s.exe
copy s.exe \cpx\bdefse\smain.exe
cd \cpx\smain
```

The list of files to be linked is found in SMAIN.LNK:

```
smain ssendm sdmsg entrout exec tgtdat msgrout fwdmsg
commsub firesch ckbuf airngf weffect saudit getmnm
shomsg
/SE:256
nul
panel04.lib strings.lib
```

APPENDIX L

REPORTER PROCEDURES

Once the scenario is completed and the PC program is exited, you can start the data base report.

First, the data files HEADER.DAT and AMMO.DAT must be copied. If the dBASE Reporter program is installed on the instructor terminal, copy HEADER.DAT and AMMO.DAT into the reporter directory. For example, if IMAIN.EXE is in the C:\CPX> directory and Reporter is in C:\REPORTER>, type the following at the C:\CPX> prompt:

copy header.dat c:\reporter <ENTER>
copy ammo.dat c:\reporter <ENTER>.

However, if the Reporter program is not installed on the instructor terminal, then the files HEADER.DAT and AMMO.DAT must be copied from the instructor terminal to a blank, formatted 5.25 inch floppy disk. Next, copy the files from the floppy disk onto the computer that houses the Reporter program. For example, if IMAIN.EXE is in the C:\CPX> directory, type the following at the C:\CPX> prompt:

copy header.dat a: <ENTER>
copy ammo.dat a: <ENTER>.

Once both files are copied, they can be transferred to the computer housing the Reporter program. If the Reporter program is in the C:\REPORTER> directory, type the following at the C:\REPORTER> prompt:

copy a:*.* c: <ENTER>.

Once the two files have been copied, type reporter <ENTER>. The CPX REPORTER MENU will be displayed on the screen.

NOTE: All reports go to the printer - so make sure it is turned on and on line.

The program is menu driven.

APPENDIX M

dBASE REPORTS

CPX Installation

1. PROGRAM: INITIAL.PRG

2. PURPOSE: This program starts the report system and initializes all necessary tables before calling the generated CPX menu system. It imports data from "HEADER.DAT" and other "AMMO.DAT" files that were produced by "IMAIN.EXE" while running a CPX exercise.

3. METHOD: The menu system was generated by the dBASE IV 1.1 application generator and is called "CPX". It calls several small programs at each menu node. These are all "*.PRG" files. The application imports data dumped by the "IMAIN. EXE" FORTRAN program into ASCII delimited format. This file "INITIAL.PRG", imports the data into unsorted dBASE files. This data is left in unsorted format until it is required by a report node: "HEADER1.PRG", "HEADER2.PRG", OR "AMMO.PRG", etc. The unsorted files are called "HRAW", "ARAW" etc., and will later be sorted and transferred to "HEADER", "AMMO", etc. The reports generated by the dBASE IV report generator operate on the "HEADER" and "AMMO" files.

```
Load HEADER information into dBASE format (unsorted)
USE HRAW
DELETE ALL
PACK

APPEND FROM HEADER.DAT TYPE DELIMITED

Replace single character type codes with their text
equivalents

Replace for C = "1" C with "SPRT;FIRE"
Replace for C = "3" C with "AFU;BAMOUP"
Replace for C = "4" C with "AFU;UPDATE"
Replace for C = "5" C with "ATI;CDR"
Replace for C = "6" C with "ATI;SHR"
Replace for C = "7" C with "FM;EOM"
Replace for C = "8" C with "FM;RFAF"
Replace for C = "9" C with "FM;OBCO"
Replace for C = "A" C with "SYS;PTM"
Replace for C = "B" C with "SYS;SUBS"
```

```
Replace for C = "C" C with "SPRT;TGT"
Replace for C = "D" C with "SPRT;GEOM"
Replace for C = "E" C with "SPRT;AIR/NGF"

Replace Fire Plan/Series Originator Names with their text
call names.

Replace for Onum = "0047" or with "Series Arthur"
Replace for Onum = "0066" or with "Group C1C"
Replace for Onum = "0101" or with "Group C2C"
Replace for Onum = "0102" or with "Series Bill"
Replace for Onum = "0150" or with "Plan Chuck"
Replace for Onum = "0157" or with "Group C3C"
Replace for Onum = "0173" or with "Series Dave"
Replace for Onum = "0221" or with "Plan Eric"
Replace for Onum = "0231" or with "Plan Fred"
Replace for Onum = "0235" or with "Series Greg"
Replace for Onum = "A285" or with "Group C4C"
Replace for Onum = "B285" or with "Group C5C"
Replace for Onum = "A292" or with "Group C6C"
Replace for Onum = "B292" or with "Series Hank"
Replace for Onum = "0312" or with "Series Ivan"

Load AMMO information into dBASE format (unsorted)

USE ARAW
DELETE ALL
PACK

APPEND FROM AMMO.DAT TYPE DELIMITED

Call the main dBASE IV generated application menu system

Use Header
DO CPX
```

Non-Scenario Player Messages

1. PROGRAM: REPORT

2. PURPOSE: To report on data extracted from the CPX system.

3. SYSTEM: dBASE IV version 1.1

4. COMMENTS: This Node prints all messages sent by all non-scenario players. The report groups by originating key and then by non-scenario and target number.

5. REFERENCE: "REPORTER.PRG" comments.

```
USE HRAW

ERASE Header.dbf

SORT TO Header ON Onum,TgtNum,Min FOR Mnum <> "0"

USE Header

SET PROCEDURE TO "Common.Prg"
DO Rep_Proc WITH "Header1.frm"
```

Player Records

1. PROGRAM: REPORT

2. PURPOSE: To report on data extracted from the CPX system.

3. SYSTEM: dBASE IV version 1.1

4. COMMENTS: This Node prints all records related to each player (student or instructor). Total processing time and averages are printed. This report groups by Sender.

5. REFERENCE: "REPORTER.PRG" comments.

```
USE HRAW

ERASE Header.dbf

SORT TO Header Se,MIN,Re FOR Mnum <> "0" .AND. Re <> "F9"

USE Header

SET PROCEDURE TO "Common.Prg"
DO Rep_Proc WITH "Header2.frm"
```

Fire Mission Records

1. PROGRAM: REPORT

2. PURPOSE: To report on data extracted from the CPX system.

3. SYSTEM: dBASE IV version 1.1

4. COMMENTS: This Node prints all records related to a fire mission that is not generated by a fire plan or series.

5. REFERENCE: "REPORTER.PRG" comments.

```
USE HRAW

ERASE Header dbf

SORT TO  Header ON Onum,TgtNum,Min FOR ReportType = "1" .AND.
MNum <> "0" .AND. R

USE Header

SET PROCEDURE TO "Common.Prg."
DO Rep_Proc WITH "Header3.frm"
```

Fire Plan or Series Records

1. PROGRAM: REPORT

2. PURPOSE: To report on data extracted from the CPX system.

3. SYSTEM: dBASE IV version 1.1

4. COMMENTS: This Node prints all records related to a fire plan or series. The report groups by Originating Key and then by non-scenario and target number.

5. REFERENCE: "REPORTER.PRG" comments.

```
USE HRAW

ERASE Header.dbf

SORT TO Header ON Onum,TgtNum,Min FOR ReportType = "2" .AND.
MNum <> "0" .AND. R

USE Header

SET PROCEDURE TO  "Common.Prg"
DO Rep_Proc WITH  "Header4.frm"
```

Critical Events Records

1. PROGRAM: REPORT

2. PURPOSE: To report on data extracted from the CPX system.

3. SYSTEM: dBASE IV version 1.1

4. COMMENTS: This Node prints all records related to critical events. The report groups by Originating Key and then by non-scenario and target number.

5. REFERENCE: "REPORTER.PRG" comments.

```
USE HRAW

ERASE Header.dbf

SORT TO Header ON Onum,TgtNum,Min FOR ReportType = "3" .AND.
MNum <> "0" .AND. R

USE Header

SET PROCEDURE TO  "Common.Prg"
DO Rep_Proc WITH  "Header5.frm"
```

Radar Target Records

1. PROGRAM: REPORT

2. PURPOSE: To report on data extracted from the CPX system.

3. SYSTEM: dBASE IV version 1.1

4. COMMENTS: This Node prints all records generated for a Radar Target.

5. REFERENCE: "REPORTER.PRG" comments.

```
USE HRAW

ERASE Header.dbf

SORT TO Header ON Onum,TgtNum,Min FOR ReportType = "9" .AND.
MNum <> "0" .AND. R

USE Header

SET PROCEDURE TO  "Common.Prg"
DO Rep_Proc WITH  "Header6.frm"
```

Shell Report Records

1. PROGRAM: REPORT

2. PURPOSE: To report on data extracted from the CPX system.

3. SYSTEM: dBASE IV version 1.1

4. COMMENTS: This Node prints all records generated for a shell report.

5. REFERENCE: "REPORTER.PRG" comments.

```
USE HRAW

ERASE Header.dbf

SORT TO Header ON Onum,TgtNum,Min FOR ReportType = "A" .AND.
MNum <> "0" .AND. R

USE Header

SET PROCEDURE TO  "Common.Prg"
DO Rep_Proc WITH  "Header7.frm"
```

Ammunition Messages Received by T1

1. PROGRAM: REPORT

2. PURPOSE: To report on data extracted from the CPX system.

3. SYSTEM: dBASE IV version 1.1

4. COMMENTS: This Node prints all ammunition messages received by T1.

5. REFERENCE: "REPORTER.PRG" comments.

```
USE ARAW

ERASE Ammo.dbf

SORT TO Ammo ON FUnit,Shell,Fuze FOR Re = "T1"

USE Ammo

SET PROCEDURE TO  "Common.Prg"
DO Rep_Proc WITH  "Ammo1.frm"
```

Ammunition Messages Fired by Z2 Grouped by Firing Unit

1. PROGRAM: REPORT

2. PURPOSE: To report on data extracted from the CPX system.

3. SYSTEM: dBASE IV version 1.1

4. COMMENTS: This Node prints all ammunition messages fired by the Shooter. It is grouped by Firing Unit.

5. REFERENCE: "REPORTER.PRG" comments.

```
USE ARAW

ERASE Ammo.dbf

SORT TO Ammo ON FUnit,Shell,Fuze FOR Re = "Z2" .AND. Re <> "F9"

USE Ammo

SET PROCEDURE TO  "Common.Prg"
DO Rep_Proc WITH  "Ammo2.frm"
```

Ammunition Messages Fired by Z2 Grouped by Shell Type

1. PROGRAM: REPORT

2. PURPOSE: To report on data extracted from the CPX system.

3. SYSTEM: dBASE IV version 1.1

4. COMMENTS: This Node prints all ammunition messages fired by the Shooter. It is grouped by Shell Type.

5. REFERENCE: "REPORTER.PRG" comments.

```
USE ARAW

ERASE Ammo.dbf

SORT TO Ammo ON FUnit,Shell,Fuze FOR Re = "Z2" .AND. F = 1 .AND.
Re <> "F9"

USE Ammo

SET PROCEDURE TO  "Common.Prg"
DO Rep_Proc WITH  "Ammo3.frm"
```

APPENDIX N

ABBREVIATIONS AND ACRONYMS

AFU	artillery fire unit
AHB	attack helicopter battalion
ATI	artillery target intelligence
BAMOUP	battalion fire unit ammunition update (TACFIRE message)
BDE	brigade
BN	battalion
BTRY	battery
CDR	(1) commander (2) coordinate report
CHG	charge
CPX	command post exercise
DIV	division
DIVARTY	division artillery
DS	direct support
EOM	end of mission
FA	field artillery
FASCAM	family of scatterable mines
FDC	fire direction center
FDO	fire direction officer
FFE	fire for effect
FIST	fire support team
FLOT	forward line of troops
FM	fire mission
FO	forward observer
FP	fire plan

FPF	final protective fire
FSCOORD	fire support coordinator
FSE	fire support element
FSO	fire support officer
FST	fire support team (TACFIRE message format field)
FU	fire unit
GEO	geometry (TACFIRE message)
GZ	grid zone (TACFIRE message format field)
HOW	howitzer
MM	millimeter
MSGS	messages
MTR	mortar tracking radar
NORDS	Number of rounds (TACFIRE message format field)
OB	observer (TACFIRE message format field)
OBCO	observer coordinates (TACFIRE message)
OPLAN	operations plan
OPORD	operations order
OPS	operations
PLT	platoon
PTM	plain text message (TACFIRE)
R	reinforcing
RFAF	request for additional fire (TACFIRE message)
S2	intelligence staff officer
S3	operations staff officer
SBT	subscriber table (TACFIRE message)
SHR	shell report (TACFIRE message)

SLAR	side looking airborne radar
SME	subject matter expert
SPRT	support (TACFIRE message)
STR	strength (TACFIRE message format field)
SYS	system (TACFIRE message)
TAB	target acquisition battery
TACFIRE	tactical fire direction system
TF	task force
TGT	target
TOT	time on target
USAFAS	United States Army Field Artillery School